DOCUMENT RESUME

ED 296 970 SP 030 357

AUTHOR Seyfarth, John T.
TITLE Effects of Change in Teacher-Pupil Ratios and Teachers' Salaries on Achievement and Dropouts.
PUB DATE Apr 88
NOTE 20p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 5-9, 1988).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; Analysis of Variance; Class Size; *Dropout Rate; Elementary Secondary Education; Policy Formation; Regression (Statistics); *Teacher Salaries; *Teacher Student Ratio; Teaching Conditions
IDENTIFIERS Virginia

ABSTRACT

This study examined three questions: (1) Are district-wide reductions in teacher-pupil ratios related to gains in reading and mathematics achievement for students in grades 4, 8, and 11? (2) Are district-wide reductions in teacher-pupil ratios related to decreases in the percentage of students who leave school between grades 8 and 12 without graduating? and (3) Is there evidence that policy decisions on teachers' salaries are influenced by other policies such as changes in teacher-pupil ratios or by changing conditions, such as enrollment increases or decreases? Data were obtained from 135 Virginia districts for the years 1978-79 and 1985-86, and comparisons were made of changes in teacher-pupil ratios, achievement test scores, teahcer's salaries, and dropout rates. No evidence was found linking reductions in teacher-pupil ratio to student achievement. Beginning teachers' salary was modestly related to achievement in mathematics in the fourth and eight grade levels. Changes in teacher-pupil ratios and beginning teachers' salary were both related to lower dropout rates, but lowering ratios were not commonly assumed to produce that outcome by policymakers. Decisions on reducing teacher-pupil ratios were not made independently of decisions on salary levels, but a relationship was found between changes in total district enrollment and teachers' salaries. (JD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED296970

Effects of Change in Teacher-Pupil Ratios and Teachers' Salaries on Achievement and Dropouts

John T. Seyfarth
Virginia Commonwealth University
Richmond, VA 23284

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

J. T. Seyfarth

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

SP030357

Presented at the annual meeting of
American Educational Research Association
New Orleans
April 1988

Introduction

During the past ten years, energetic efforts to improve the quality of schooling have been undertaken across the United States. This period has seen state governments reassume leadership in educational reform after a long period during which the federal government had taken the lead in development and funding of educational initiatives (Frazier, 1987). While the federal government sought to improve educational opportunity for underprivileged populations and minorities through targeted programs, the states as a rule have focused on achieving across-the-board improvements in student achievement. These efforts have involved raising requirements for high school graduation and providing additional resources to permit schools to attract better qualified teachers and to provide a wider variety of services.

A number of administrative actions and policy reforms are being tried in the schools in an effort to increase both the supply and the quality of the teaching force. Among these are more selective and rigorous training programs, higher academic standards enforced through teacher examinations, changes in teachers' role and responsibilities, and better compensation (Ferris & Winkler, 1986).

One concern that has been expressed is that programs designed to attract more capable persons into teaching will have little long-run impact on teacher quality unless they are accompanied by changes in the working conditions in schools that will help to retain those individuals who choose teaching careers (Schlechty & Vance, 1983).

One of the characteristics of working conditions in schools that has implication for teacher satisfaction and retention is teacher-pupil ratio. Teachers generally prefer teaching smaller classes and, other things being equal, will choose to work in districts in which smaller teacher-pupil ratios prevail.

Substantial reductions in teacher-pupil ratios in American schools have occurred over the past fifty years. Edmonston and Knapp (1979) estimated that the average ratio of students to teachers nationwide in grades 1 through 4 dropped from 35 to 22, a 37.1 percent decrease, between 1933-34 and 1977-78. For grades 5 through 8, the average ratio declined from 31 to 21, a drop of 32.3 percent, and for grades 9 through 12, the ratio dropped from 27 to 19, a decrease of 29.6 percent.

Reductions in teacher-pupil ratios have at least three potential benefits for children. The first of these is that, by permitting teachers to spend more time with individual students, they lead to increased learning. Klein (1985), summarizing the research on class size, reported that the most significant learning gains from reductions in teacher-pupil ratios occurred in classes of fewer than 15 students and that above about 20 students per teacher, reductions had relatively little impact on learning gains.

Bridge, Judd, and Moock (1979) cited six comparisons in which district achievement scores were the dependent variable. Significant differences in student achievement attributable to smaller class size were found in only two of the six.

Observational studies reported by Klein (1985) showed that reductions in class size had relatively little effect on teachers' instructional strategies. Teachers who were observed teaching both small and large classes used similar strategies in both, including devoting about the same amount of time to individualized instruction, even though in larger classes less time was available per student for assistance.

The second potential benefit for students from reducing teacher-pupil ratios in schools is increased student success, leading to lower dropout

rates. Students who leave school without graduating do so for a number of reasons, of which lack of academic success is only one. For that group, reductions in teacher-pupil ratios would be expected to have some impact, provided the reductions were substantial enough to permit significantly more individualized attention from teachers and provided that the reductions occurred early enough that a pattern of failure could be avoided. There has been relatively little research on the impact of reductions in teacher-pupil ratios on dropout behavior. That may be due in part to the difficulties encountered in attempting to define and to measure dropout rate.

The third possible benefit to children from reductions in teacher-pupil ratios is that more highly qualified individuals will be attracted to careers in teaching and that competent teachers who might otherwise be inclined to leave the field will be induced to stay in the classroom. Class size is only one of many factors that affect the quality of teachers' work-lives, but it appears to have a strong influence on teachers' feelings of job satisfaction (Glass & Smith, 1979).

Reducing teacher-pupil ratios offer policymakers an opportunity to achieve policy objectives that cannot be attained in other ways. For example, districts that are not able to match the salaries paid by more affluent districts sometimes offer smaller classes as an inducement. The best known example of this is private schools, which are frequently able to employ good teachers in spite of paying relatively low salaries, by advertising small classes and more highly motivated students.

Reductions in teacher-pupil ratios are an attractive alternative to reductions in force during times of declining enrollments. They are especially attractive as a policy option when enrollment losses are expected to be temporary or when policymakers expect attrition to absorb excess staff over the near term.

Resources devoted to reducing teacher-pupil ratios are necessarily lost to other uses. These funds cannot be spent, for example, to provide improved staff development programs or to purchase computers for students' use. The question policymakers must ask is which of the many alternative uses of school resources are most likely to result in desirable outcomes.

There is general agreement among both educators and laypersons that teachers' salaries are low in comparison with occupations that require similar levels of preparation (Carnegie Forum on Education and the Economy, 1986). Since reductions in teacher-pupil ratio divert resources that might be used to improve teacher pay, there is a question whether spending the money for that purpose is the best use of it (Anderson & Mark, 1985). In deciding to use school resources to reduce teacher-pupil ratios policymakers are making a political choice (Sroufe, 1977). In districts in which salaries are high enough to attract the teachers needed to staff the schools, there may be less pressure on policymakers to increase teachers' salaries and greater pressure to reduce teacher-pupil ratios. Many parents believe their children profit more directly from class-size reductions than they do from salary increases. Since teachers also appreciate reductions in class sizes, policymakers find that an attractive option.

Research Design

This study examined three questions:

(1) Are district-wide reductions in teacher-pupil ratios related to gains in reading and mathematics achievement for students in grades 4, 8, and 11?

(2) Are district-wide reductions in teacher-pupil ratios related to decreases in the percentage of students who leave school between grades

8 and 12 without graduating?

(3) Is there evidence that policy decisions on teachers' salary are influenced by other policies such as changes in teacher-pupil ratios or by changing conditions, such as enrollment increases or decreases?

Data for the study were obtained from two sources. Information on district-wide teacher-pupil ratios, achievement test scores, and dropout rates were obtained from the Divison of Management Information Services of the Virginia Department of Education. Information on teachers' salaries came from the Virginia Education Association.

Information furnished by the Department of Education was compiled from yearly reports submitted by district superintendents. The education association annually compiled information on beginning teachers' salaries in all districts in the state from data supplied by the districts to representatives of the association.

Data were obtained from 135 districts for the years 1978-79 and 1985-86, and comparisons were made of changes in teacher-pupil ratios, achievement test scores, teachers' salaries, and dropout rates over that period of time. These years were selected for two reasons. The year 1978-79 was chosen because by that time Public Law 94-142 (Education for All Handicapped Children Act) had been fully implemented and further reductions in teacher-pupil ratios would therefore result from policy actions at the state or local level. The year 1985-86 was selected because it was the most recent year for which data were available.

Regression analysis was used to obtain answers to Questions 1 and 2. Analysis of variance was used to obtain an answer to Question 3.

Findings

Table 1 presents intercorrelations among 10 variables used in the study. These correlations involve gain scores obtained by taking the difference between 1978 and 1985 data. District mean achievement test scores for 1978 were subtracted from the corresponding 1985 scores to obtain achievement gain scores in reading and mathematics for grades 4, 8, and 11. Teacher-pupil ratios were calculated for grades K-7 and 8-12 by dividing enrollments for those grades by total instructional personnel. Instructional personnel is defined by the Virginia Department of Education to include classroom teachers as well as support personnel (librarians, counselors, principals, and supervisors). Changes in teacher-pupil ratios were obtained by subtracting the 1985 ratio from the 1978 figure. Change in salary was calculated by subtracting the 1978 beginning teachers' salary from the 1985 salary. Change in dropout rate was obtained by subtracting the 1978 dropout rate from the 1985 figure.

Teacher-pupil ratios declined over the period at both elementary and secondary levels. The median 1985 ratio for grades K-7 was 16.07 students per instructional professional, a decrease of 1.72 (9.5 percent) from the 1978 figure. For grades 8-12, the median 1985 figure was 14.35, a decrease of 1.35 (8.6 percent) from the 1978 level. Tables 2-4 report estimated beta values, standard errors, and significance levels obtained from the regression analyses on achievement test gain scores. As expected, 1978 achievement test scores for the same grade level explained a significant amount of variance in the change scores for both subjects at all three grade levels. For the fourth and eighth grades, previous scores were significant at the .0001 level of probability. For eleventh grade, previous reading scores were significant at the .01 level of probability, and 1978 mathematics

scores were significant at the .0001 level. Teacher-pupil ratios failed to explain a significant amount of variance in any of the analyses. Beginning teachers' salary was significant only for fourth and eighth grade mathematics ($P < .05$).

Dropout rates in school districts in Virginia declined by a median 1.4 percent between 1978 and 1985. The range was from -5.37 to 6.77. Table 5 shows the results of a regression analysis using dropout rate as the dependent variable. Both secondary teacher-pupil ratio and change in beginning teachers' salary explained significant amounts of variance in the dependent variable. The level of probability was .05 in both cases.

Analysis of variance was used to obtain an answer to Question 3 (whether teachers' salary is related to changes in enrollment and in teacher-pupil ratios). Districts were assigned to quartiles on total enrollment change and on change in teacher-pupil ratio for grades K-12. The results of the analysis appear in Table 6. The dependent variable was the 1985 beginning teachers' salary. Both independent variables were significantly related to the level of teacher compensation. For enrollment change, the F-ratio of 10.14 (df=3, 124) was significant at the .0001 level. For change in teacher-pupil ratio, the F-ratio was 4.62 (df=3, 124) was significant at the .004 level of probability. Examination of mean salary levels for districts in each of four groups ranging from low to high on change in teacher-pupil ratio showed that the districts with the smallest change in teacher-pupil ratio had the lowest mean salary level, while the highest salary was paid by districts that were second lowest in teacher-pupil ratio change. These data appear in Table 7. That table also reports salary figures for districts grouped on the basis of total enrollment change. The highest

mean salary was paid by districts with the least enrollment change, and the lowest salaries were paid by districts with the next-to-highest enrollment difference.

Summary and Discussion

This study examined the relationship of changes in teacher-pupil ratios to two outcomes of schooling--achievement gains and change in dropout rate. By making it possible for teachers to spend more time with each student in their classes, reductions in the teacher-pupil ratio could be expected to lead to increased student achievement and, indirectly, to heightened feelings of success. These results could contribute in turn to lower school dropout rates. No evidence was found linking reductions in teacher-pupil ratio to student achievement. Beginning teachers' salary was modestly related to student achievement in mathematics at the fourth and eighth grade levels. Changes in teacher-pupil ratios and beginning teachers' salary were both related to changes in dropout rates in the school districts studied.

These findings open to question the conventional rationale for reducing class size as a way of achieving lower dropout rates. The results suggest that lower teacher-pupil ratios contribute to lower dropout rates but that the mechanism is not the one that is commonly assumed to produce that outcome.

This study found that decisions on reducing teacher-pupil ratios were not made independently of decisions on salary levels. Significant differences in salary levels were found from analysis of variance on districts grouped on the basis of changes in teacher-pupil ratio. Districts with the largest reductions in teacher-pupil ratio (reductions of 2.19 or more

students per professional) reported the lowest teachers' salaries for 1985-86. The mean salary for that group was $14,681. For the other three groups, mean salaries ranged from $15,236 to $15,592. Districts with the next-to-highest level of reduction in teacher-pupil ratio (reductions ranging from 1.65 to 2.19 student per professional) reported paying the highest mean salaries ($15,592).

A relationship was also found between changes in total district enrollment and teachers' salary. The majority of districts experienced enrollment declines during the period from 1978 to 1985. Of the 135 districts in the state, only 14 reported enrollment gains. The largest mean teachers' salary was paid by districts with the largest enrollment losses ($16,047). In those districts, enrollments declined by 832 or more students. The lowest mean salary ($14,779) was paid in districts with enrollment declines between 149 and 427 students.

References

Anderson, B. & Mark, J. (1985). Improving teacher salaries: merit pay isn't enough. In H. C. Johnson Jr. (Ed.). Merit, money and teachers' careers. New York: University Press. Pp. 169-182.

Bridge, R. G., Judd, C. M., and Moock, P. R. (1979). The determinants of educational outcomes. Cambridge, MA: Ballinger.

Carnegie Forum on Education and the Economy. (1986). A nation prepared: teachers for the 21st century. New York: Carnegie Corporation.

Edmonston, B. & Knapp, T. R. (1979). A demographic approach to teacher supply and demand. American Educational Research Journal, 16, 351-366.

Ferris, J. & Winkler, D. (1986). Teacher compensation and the supply of teachers. Elementary School Journal, 86, 389-403.

Frazier, C. M. (1987). The 1980s: the states assume educational leadership. In J. Goodlad (Ed.). The ecology of school renewal. Eighty-sixth yearbook of the National Society for the Study of Education. Chicago: University of Chicago Press. Pp. 99-117.

Glass, G. V. & Smith, M. L. (1978). Meta-analysis of research on the relationship of class size and achievement. San Francisco: Far West Laboratory for Educational Research and Development.

Klein, K. (1985). The research on class size. Phi Delta Kappan, 66, 578-580.

Schlechty, P. C. & Vance, V. S. (1983). Recruitment, selection, and retention: the shape of the teaching force. Elementary School Journal, 84, 470-487.

Sroufe, G. E. (1977). Evaluation and politics. In J. Scribner (Ed.). The politics of education. Seventy-sixth yearbook of the National Society for the Study of Education. Chicago: University of Chicago Press. Pp. 287-318.

Table 1

INTERCORRELATIONS AMONG ALL VARIABLES

		2	3	4	5	6	7	8	9	10
1.	Reading gain (4th)	.63***	.28**	.25**	.19**	.17*	-.02	-.02	.06	-.17
2.	Mathematics gain (4th)	--	.17*	.28***	.07	.07	.01	-.05	.08	-.21*
3.	Reading gain (8th)	--	--	.67***	.33***	.25**	.03	.14	-.05	-.06
4.	Mathematics gain (8th)	--	--	—	.27**	.28***	-.01	.11	.10	.07
5.	Reading gain (11th)	--	--	--	--	.73***	.08	-.02	-.03	.09
6.	Mathematics gain (11th)	--	--	--	--	--	.07	.13	-.05	.09
7.	Change in teacher-pupil ratio (K-7)	--	--	--	--	--	--	-.14	-.09	.07
8.	Change in teacher-pupil ratio (8-12)	--	--	--	--	--	--	--	-.18*	.17*
9.	Change in beginning teacher's salary	--	--	--	--	--	--	--	--	.12
10.	Change in dropout rate	--	--	--	--	--	--	--	--	--

* P <.05
** P <.01
*** P <.001

Table 2

ESTIMATED BETA VALUES, STANDARD ERRORS, AND SIGNIFICANCE LEVELS FOR FOURTH GRADE

	READING		
	Beta	Standard Error	t
Intercept	11.34	3.99	2.84**
Teacher-pupil ratio (K-7)	-0.11	0.35	-0.32
Beginning salary	0.0009	0.0005	1.63
Mean reading score	-0.30	0.05	-5.57***

F (3,124)=10.41*** R^2 = .20

	MATHEMATICS		
	Beta	Standard Error	t
Intercept	18.89	5.97	3.16**
Teacher-pupil ratio (K-7)	0.18	0.50	0.35
Beginning salary	0.002	0.0008	2.08*
Mean mathematics score	-0.45	0.09	-4.96***

F (3,124)=8.44*** R^2 = .17

* P <.05
** P <.01
*** P <.001

Table 3

ESTIMATED BETA VALUES, STANDARD ERRORS, AND SIGNIFICANCE LEVELS FOR EIGHTH GRADE

	READING		
	Beta	Standard Error	t
Intercept	21.12	3.89	5.44***
Teacher-pupil ratio (K-7)	0.006	0.38	0.15
Beginning salary	0.0001	0.0006	0.186
Mean reading score	-0.25	0.06	-4.39***

F (3,124)=6.71** R^2 = .14

	MATHEMATICS		
	Beta	Standard Error	t
Intercept	25.41	5.06	5.02***
Teacher-pupil ratio (K-7)	-0.27	0.46	-0.59
Beginning salary	0.001	0.0007	1.98*
Average mathematics score	-0.38	0.09	-4.46***

F (3,124)=7.01** R^2 = .14

* P <.05
** P <.01
*** P <.001

Table 4

ESTIMATED BETA VALUES, STANDARD ERRORS, AND SIGNIFICANCE LEVELS FOR ELEVENTH GRADE

	READING		
	Beta	Standard Error	t
Intercept	20.41	4.15	4.92***
Teacher-pupil ratio (8-12)	-0.15	0.44	-0.34
Beginning salary	0.0002	0.0006	0.28
Mean reading score	-0.19	0.06	-3.02**

F (3,123)=3.13** R^2 = .07

	MATHEMATICS		
	Beta	Standard Error	t
Intercept	26.13	4.58	5.70***
Teacher-pupil ratio (8-12)	0.39	0.48	0.81
Beginning salary	0.0009	0.0007	1.32
Average mathematics score	-0.45	0.07	-6.23***

F (3,123)=14.16*** R^2 = .26

* P <.05
** P <.01
*** P <.001

Table 5

ESTIMATED BETA VALUES, STANDARD ERRORS, AND SIGNIFICANCE LEVELS FOR DROPOUT RATE

	Beta	Standard Error	t
Intercept	-4.06	1.05	-3.86**
Teacher-pupil ratio	0.24	0.12	2.05*
Beginning salary	0.0004	0.0002	2.36*

$F(2,125)=4.16^{*}$ $R^2 = .06$

* P <.05
** P <.01

Table 6

RESULTS OF ANALYSIS OF VARIANCE OF 1985 TEACHERS' SALARY
BY CHANGE IN TEACHER-PUPIL RATIO AND ENROLLMENT CHANGE

Source	df	Sum of Squares	Mean Square	F	Prob.
Model	6	52,497,552.40	8,749,592.07		
Enrollment change	3	36,067,004.19		10.14	.0001
Teacher-pupil ratio	3	16,430,548.20		4.62	.0044
Error	124	146,967,686.15			

Table 7

MEAN 1985-86 TEACHERS' SALARIES PAID BY DISTRICTS GROUPED BY CHANGE IN TEACHER-PUPIL RATIO AND BY ENROLLMENT CHANGE

T-P ratio	N	Mean salary	Enrollment	N	Mean salary
Group 1	35	$14,681	Group 1	35	$16,046
Group 2	34	15,592	Group 2	32	14,796
Group 3	32	15,236	Group 3	33	14,779
Group 4	30	15,447	Group 4	31	15,228